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Marine Polymers Coating Food

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We will investigate the effects of biopolymer coating of fresh fruits/vegetables as a protection system to improve their shelf-life during storage. Two abundant marine polymers, namely ulvan and chitosan, which have been reported to possess a number of functional properties relevant for food preservation, will be used. Importantly, chitosan and ulvan are both non-toxic and have already been approved for food applications.

Ulvan is a sulfated cell wall heteropolysaccharide (Figure 1 and 2) from green seaweeds *(Ulva and Enteromorpha species)* (Figure 3), with innovative structural and functional properties (1). It was recently described to induce disease resistance in plants (Figure 4) (2,3). It is important to note that ulvan represents an abundantly available, yet under-exploited renewable resource since *Ulva* species are often involved in uncontrolled proliferation resulting in eutrophication of coastal and lagoon waters (4).

Chitosan is a polymer composed of variable amounts of the monomeric units N-acetylglucosamine and D-glucosamine (Figure 5). Commercially, it is obtained by deacetylation of chitin, the main component of the exoskeleton of crustaceans. This polymer presents well-documented favorable biological properties such as biocompatibility, biodegradability and low toxicity, and due to these characteristics, chitosan is a very attractive polymer for several applications in the food industry (5). Furthermore, chitosan is an antimicrobial compound active against a wide range of target organisms (5).

The low cost, sustainable materials ulvan and chitosan are promising candidates as potential coating components to preserve food (Figure 6) due to their gel forming properties, but even more so due to the antimicrobial activity of chitosan and the ability of ulvan to induce disease resistance in plants. We will investigate whether ulvan has a similar resistance-inducing activity towards selected fruits/vegetables and how the negatively charged ulvan influences the biological activities of the positively charged chitosan. This project will lay the base for the use of biocompatible polymers gained from waste fractions as an environment-friendly and consumer-safe alternative to protect fresh fruits/vegetables, significantly increasing their economic value.

Figure 1.
The polysaccharide extracted from green seaweeds: ulvan.
(a: ulvan, b: ulvan dialysed)

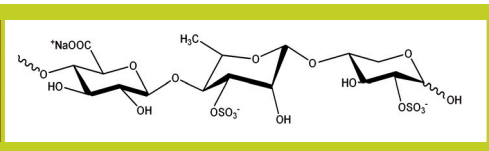

Figure 2.
Chemical structure of ulvan.
(Glucuronic acid -› Rhamnose -› Xylose)

Figure 3.
The green seaweed *Ulva fasciata*.

Figure 4.
Wheat plants (Triticum aestivum L. cv Kanzler) infected with Blumeria graminis f. sp. tritici. (a) control plants; (b) ulvan treated plants

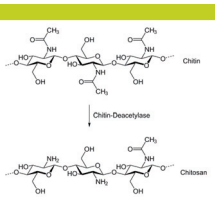

Figure 5.
Chitosan is a polysaccharide composed of randomly distributed ß-(1-4)-linked D-glucosamine and N-acetyl-D-glucosamine units obtained by deacetylation of chitin.

Figure 6.
Coating fresh fruits/vegetables with marine polymers.